

Remarks

Claims 1, 2 and 4-24 are pending in this application. Claims 1, 4, 14 and 15 are amended. No new matter has been added as a result of the above amendments.

On June 25, 2004, Applicant's attorney, Jacob Erlich, spoke with Examiner Duong and informed him that the Applicant was going to amend the claims to more positively recite in the body of the independent claims the patentable limitations dealing with the substrate alignment characteristics as well as the utilization of the fabrication technique for making the electrooptic device of the present invention. The Examiner agreed to call attorney Erlich upon review of the present response if the case is not in condition for allowance and further discussions are needed.

Rejection of claims 4 and 15 under 35 USC § 112, second paragraph

Claims 4 and 15 are rejected under 35 USC § 112, second paragraph as failing to set forth the subject matter which applicant regards as their invention.

The Examiner states that claims 4 and 15 fail to correspond in scope with that which applicant regards as the invention in that "applicant has stated that the thickness of a PDLC film is preferably approximately 5-20 micrometers, and this statement indicates that the invention is different from what is defined in the claims because 7-micrometer is excluded in the range from about 5-6 micrometers to about 8-20 micrometers."

Applicant has amended claims 4 and 15 to conform with the Examiner's suggestion of a separation "from about 5 μm to about 20 μm ". Thus, the 35 U.S.C. § 112 rejection has been overcome, and dependent claims 4 and 15 should be found allowable since they depend from allowable independent claims for the reasons presented below.

Rejection of claims 1, 2, 4-6 and 14-17 under 35 USC 102(b)

Claims 1, 2, 4-6 and 14-17 are rejected under 35 USC 102(b) as being anticipated by Yamada *et al.* (US 5,668,651). Applicant respectfully disagrees.

The Examiner states, in summary, that Yamada discloses a method for fabricating a liquid crystal display comprising providing a nematic liquid crystal and a photo-curable pre-polymer mixture, mixing the nematic liquid crystal with the photo-curable pre-polymer mixture to form a homogeneous nematic/pre-polymer mixture; providing a cell having a pair of spaced apart transparent substrates coated with a transparent conductive layer; filling the cell with the homogeneous mixture and photocuring the mixture using a spatially inhomogeneous illumination source.

Section 102 of Title 35 provides the novelty requirements for patentability. In order for a prior art reference to anticipate a claim it must teach each and every element of that claim. M.P.E.P. §2131. The Court of Appeals for the Federal Circuit states: "[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628 (CAFC, 1987).

Independent claims 1 and 14 have been amended in order to comply with the Examiner's helpful comments found on page 9 of the present *Office Action* which states "[t]he Examiner recognizes that there are significant distinctions between the art in Yamada and the presently claimed invention." The preamble has been clarified by amendment to reflect that the polymer liquid crystal electrooptic device is a diffractive or non-dispersive device - further, this limitation is also present within the body of the method of independent claims 1 and 14. For example, claims 1 and 14 now specifically recite "utilizing the above fabrication method to create said diffractive or non-dispersive electrooptic device in the form of a polymer dispersed liquid crystal (PDLC) exhibiting low scattering loss and high index modulation." This amendment addresses the concern of the Examiner when he states "the recitation that 'wherein said device is either diffractive or non-dispersive' has not been given patentable weight because it has been held that a preamble is denied the effect of a limitation ..."

Even further to comply with the Examiner's helpful comments, the invention as presently claimed is significantly different from that disclosed in Yamada - again, the Examiner adroitly points this out in the present *Office Action* on page 9. For example, with

respect to the use of alignment layers. The presently claimed invention includes the limitation of "without the inclusion of an alignment layer for aligning said nematic liquid crystal" which more particularly define the invention. Importantly, this amplifies a significant difference between what is currently claimed and that disclosed in Yamada. Yamada actually teaches the use of an alignment layer, while what is presently claimed does not claim such a layer. For example, the nematic liquid crystal content in Yamada's displays is aligned via two mechanisms: (1) alignment layers (15 & 17 in Figs. 1A, B) on the substrates and (2) either an electric or magnetic field applied to the display during photo-curing the micrometer-scale bulk photo-polymer walls. In contrast to Yamada, alignment in the present invention is achieved via fluid flow on a nanometer-scale. Thus, the material system in Applicant's claimed invention creates a polymer dispersed liquid crystal or PDLC, while the material in Yamada is not.

Moreover, the photo-polymer content in Yamada contains photo-polymerizable nematics, while the photo-polymer content in the present invention does not due to the materials used. Further, light traversing Yamada's displays passes through bulk nematic layers only, while in the devices of the present invention, light passes through many photo-polymer/nematic interfaces (see Figs. 2c and 3 of the present application). Yamada's displays offer low contrast switching with relatively high scattering loss, while the transmissive PDLC devices in the present invention as claimed, contrary to Yamada, achieve high contrast and low scattering loss.

The Examiner states that Yamada teaches a nematic liquid crystal. Yamada states chiral nematics or cholesteric LCs are preferred; however, the present invention prefers non-chiral nematics based on experimental data, in direct contrast with Yamada.

The Examiner also states that Yamada also teaches mixing said nematic liquid crystal with said photo-curable pre-polymer mixture to form a homogeneous nematic/pre-polymer mixture, with said nematic liquid crystal being greater than 40%(by weight) of said combined homogeneous mixture. However, Yamada teaches away from what is presently claimed. For example, col. 15, ln. 56-63 state that "[i]f the liquid crystal material accounts for less than 50% by weight ... the polymer wall matrix exercises excessive influence ... thereby ruining

practicality of the ... device." Clearly, Yamada is teaching away from what is presently claimed.

The Examiner also states that Yamada teaches filling said cell with said homogeneous nematic/pre-polymer mixture. In actuality, Yamada "injects" the LC mixture into a cell that has substrates with an "orientation treatment." As stated above, the devices of the presently claimed invention do not require any alignment treatment on the substrates.

The Examiner states that Yamada teaches photo-curing said nematic/pre-polymer mixture using a spatially inhomogeneous illumination source thereby creating the electrooptic device in the form of a polymer dispersed liquid crystal (PDLC) exhibiting low scattering loss and high index modulation. However, the Examiner on page 5 of the present *Office Action* states that "Yamada et al. discloses a method of fabricating a liquid crystal device that is basically the same as that recited ... except for the step of deriving said spatially inhomogeneous illumination source used to photo-cure the nematic/prepolymer mixture ..." The Examiner himself adroitly points to a significant difference between what is presently claimed and that which Yamada teaches.

In actuality, Yamada uses spatially inhomogeneous UV radiation to "effect a photo-polymerization" at "a temperature equal to or higher than the homogenization temperature of the [polymer/liquid crystal] mixture," as described in 9:61-10:3. In contrast, the photo-polymerization process of the present invention does not take place at elevated temperature, in fact, under elevated temperatures the present invention would not work - for example, the gratings would be lost and drift would be experienced. Additionally, the present invention does not utilize an electric or magnetic field during photo-curing, as Yamada does by necessity, as stipulated in 9:18-27 and 9:46-52 and in method claims 9, 17, and 18. Further, Yamada describes the contrast of his displays in simple scalar terms in 15:11-30. As demonstrated by Applicant, a proper description of contrast for diffractive and non-dispersive PDLC optical devices requires a tensor approach. (See US Application 20020097355.)

Clearly, the "each and every element" rule articulated above has not been satisfied and therefore, the references cited by the Examiner fails to defeat novelty for the presently

claimed invention. Therefore, Applicant respectfully requests reconsideration and withdrawal of the present rejection.

The Examiner discusses briefly pending claims 2 - 6, 15, and 17. Applicant applies the same arguments here that were previously presented. Moreover, it is axiomatic in patent law that if an independent claim defines allowable subject matter then the claims depending therefrom also define allowable subject matter. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), and Hartness International, Inc. v. Simplimatic Engineering Co., 819 F.2d 1100, 1108, 2 USPQ2d 1826, 1831 (Fed. Cir. 1987). Given that the rejected claims depend from base claims and those independent claims define allowable subject matter, then the claims at issue must necessarily define allowable subject matter. The reasons for allowability of the base claims are set forth above.

Furthermore, even if the Examiner relies upon a 35 USC 103 rejection of claims 1, 2, 4-6 and 14-17 in view of Yamada, such a rejection would be in error in view of the many significant differences that exist between the presently claimed invention and that disclosed in Yamada.

Rejection of claims 7-13 and 18-24 under 35 USC 103(a)

Claims 7-9 and 18-20 are rejected under 35 USC 103(a) as being unpatentable over Yamada *et al.* (US 5,668,651) in view of Sumiyoshi *et al.* (US 6,278,506). Claims 10-13 and 21-24 are rejected as above further in view of Popovich, et al. (US 6,339,486). Applicant respectfully disagrees.

The Examiner states that "Yamada *et al.* disclose a method of fabricating a liquid crystal device that is basically the same as that recited in claims 7-9 and 18-20 except for the step of deriving said spatially inhomogenous illumination source used to photo-cure the nematic/prepolymer mixture from the interference of two coherent optical beams within said cell." The Examiner continues, "Sumiyoshi *et al.* disclose a method of fabricating a liquid crystal cell (Fig. 5A) comprising the step of deriving a spatially inhomogenous illumination source 16 used to photo-cure a nematic/pre-polymer mixture 15a ...

Since Applicant has amended the independent claims in accordance with the Examiner's helpful suggestions, it appears that the 35 USC § 103 rejection of dependent claims 7-9 and 18-20 is no longer at issue since the independent claims appear to be allowable.

In any case, in further support of the allowability of these claims, Applicant provides the following comments:

In order to establish a *prima facie* case of obviousness, "there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references) must teach or suggest all of the claim limitations." M.P.E.P. §2143, see also, *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Further, as stated above, it is axiomatic in patent law that if an independent claim defines allowable subject matter then the claims depending therefrom also define allowable subject matter. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), and Hartness International, Inc. v. Simplimatic Engineering Co., 819 F.2d 1100, 1108, 2 USPQ2d 1826, 1831 (Fed. Cir. 1987). Given that the rejected claims depend from base claims and those independent claims define allowable subject matter, then the claims at issue must necessarily define allowable subject matter. The reasons for allowability of the base claims are set forth above.

The Examiner states "[t]hus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of fabricating a LCD device of Yamada *et al.* with the teaching of Sumiyoshi *et al.* by employing two interfering optical beams which are incident symmetrically about a direction normal to said cell in order to form said PDLC as an unslanted PDLC transmission grating so as to produce a highly bright image for the display."

To reiterate, independent claims 1 and 14 have been amended to reflect that the polymer liquid crystal electrooptic device is a diffractive or non-dispersive device. Moreover, Yamada teaches use of an alignment layer, whereas the presently claimed invention does not employ an alignment layer. These distinctions are not overcome by Sumiyoshi.

Further, the assertion that the displays of Yamada could be made using two coherent interfering UV beams according to the teaching of Sumiyoshi is inaccurate. First, consider that Yamada never mentions the use of holographic fabrication techniques in his disclosure. This is not by oversight, but rather, by design and of necessity. Consider Yamada's exposition on the production method of his art in a lengthy section entitled "Production method," found in 9:10-10:17, specifically 9:28-38 where Yamada describes the UV radiation distribution as having "weakly irradiated regions" (quotes by Yamada) that he defines as those regions "not irradiated with UV-rays" (Yamada, 9:34-35). Thus, when Yamada says, "weakly irradiated," he by his own definition means not irradiated. Holographic irradiation distributions can never produce such idealized, sharp spatial features, but rather, smooth, sinusoidally-varying spatial distributions. Strictly speaking, a holographic exposure formed by the interference of two coherent optical beams does not allow for 2-dimensional regions with zero optical (UV) radiation, as required by Yamada. Yamada appreciated this and hence never allowed for holographic production methods in his invention.

Moreover, there is no teaching, suggestion, nor motivation provided by either reference to combine. Additionally, there is no evidence suggesting that were these two references combined the result would be Applicant's claimed invention. A case of *prima facie* obviousness has not been established and therefore Applicant respectfully requests reconsideration and withdrawal of the present rejection.

Dependent claims 10-13 and 21-24 further patentably define the present invention, and since they are based upon allowable independent claims for the reasons presented above, claims 10-13 and 21-24 should also be found to be allowable.

In conclusion, in view of the above amendments and remarks, Applicant respectfully requests the Examiner find claims 1, 2 and 4-24 allowable over the prior art and issue a Notice of Allowance. In the event the Examiner has any further questions, as pointed out above, the Examiner is encouraged to call Applicant's attorney at the number provided below.

Applicant believes that no fees are due at this time, however, should there be any fees, please charge Deposit Account No. 50-1078.

The Examiner is invited to call the undersigned attorney at (617) 854-4000 should he determine that a telephonic interview would expedite prosecution of this case.

Respectfully submitted,



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